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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 10/510,208
Filing Date: October 05, 2004
Appellant(s): JOHANNESSON ET AL.

Eric J. Franklin
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 6/29/2010 appealing from the Office action mailed 7/31/2009.

**(1) Real Party in Interest**

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The following is a list of claims that are rejected and pending in the application:

3-20

**(4) Status of Amendments After Final**

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

**(5) Summary of Claimed Subject Matter**

The examiner has no comment on the summary of claimed subject matter contained in the brief.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

**(7) Claims Appendix**

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 7,034,272 | Leonard | 10-1999 |
| 5,355,309 | Eberhard | 10-1994 |
| 6,320,618 | Aoyama | 11-2001 |
| 7,027,193 | Spears et al. | 2-2001 |
| N/A | Official Notice | N/A |

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

***Claims 3-5, 7-11, and 13-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leonard et al. (US Patent 7,034,272 B1) hereinafter referenced as Leonard in view of Eberhard et al. (US Patent 5,355,309) hereinafter referenced as Eberhard.***

Regarding claim 9, Leonard discloses a method and apparatus for evaluating integrated circuit packages having three dimensional features. In addition, Leonard discloses at least one light source (12) that emits light towards the object, which reads on claimed, **"at least one light source that emits light towards the object"**, as exhibited in figures 2 and 3.

In addition, Leonard discloses a sensor (10) comprising a first area of pixels (38,40) having a first degree of resolution, the first area imaging three-dimensional geometrical characteristics of the object; and a second area of pixels (42) having a

second degree of resolution, the second area imaging two-dimensional characteristics of the object (balls, leads, edges, and corners), wherein the first area of pixels (38,40) and the second area of pixels (42) absorb electro-magnetic radiation from the object (26) and to convert the electro-magnetic radiation into electrical charges, which reads on claimed, **"a sensor comprising a first area of pixels having a first degree of resolution, the first area imaging three-dimensional geometrical characteristics of the object; and a second area of pixels having a second degree of resolution different from the first degree of resolution, the second area having two-dimensional characteristics of the object, wherein the first area of pixels and the second area of pixels absorb electromagnetic radiation from the object and convert the electromagnetic radiation into electrical charges"**, as disclosed in column 12 lines 23-47 and exhibited in figures 3, 10, and 17.

However, Leonard fails to explicitly disclose that the second area of pixels has a higher degree of resolution different from the first degree of resolution. However, the examiner maintains that it was well known in the art to provide **"a second area of pixels having a second degree of resolution different from the first degree of resolution"**, as taught by Eberhard.

In a similar field of endeavor Eberhard discloses a cone beam spotlight using multi-resolution area detector. In addition, Eberhard discloses using an image sensor with a high resolution part and a low resolution part for 3-D imaging, wherein the high resolution part is used to image the small specific parts of interest of an object which reads on claimed, **"a second a second area of pixels having a second degree of**

**resolution different from the first degree of resolution"**, as disclosed in column 7 lines 25-68, and exhibited in figures 1 and 3.

Leonard teaches using an imager with two sections, one for imaging smaller specific 2D characteristics such as balls, edges, leads, and corners of an IC and one for imaging the 3D characteristics in a much broader perspective. Eberhard teaches a multiresolution sensor wherein the high resolution part of the sensor is used to image the details of the object, while the lower resolution part of the sensor is used to image the object in a broader sense.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of using high resolution to image the details of an object and lower resolution to image the other aspects of the object, as taught by Eberhard, to the sensor (10) of Leonard so that the pixel area (42) has a higher resolution than the pixel area (38,40) to achieve the predictable result of imaging the details of the object such as balls, edges, leads, and corners with better accuracy. In addition, simply increasing the resolution of the pixel area (42) of Leonard is not dependent on any other aspect of the device.

Regarding claim 10, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 9), in addition, Leonard discloses an output register (34) arranged to read out the charges received in the sensor (10), which reads on claimed, **"an output register arranged to read out the charges received in the sensor",** as exhibited in figures 5-8.

Regarding claim 11, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 9), in addition, Leonard discloses at least two output registers (34) arranged to read out the charges received in the sensor (10), which reads on claimed, **"at least two output registers arranged to read out the charges received in the sensor",** as exhibited in figures 5-8.

Regarding claim 13, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 11), however, the combination fails to explicitly disclose that the second area of the sensor is provided with color filters wherein each color has a separate output register. However, the examiner takes official notice of the fact that it was well known in the art at the time of the invention to provide **"wherein if the second area of the sensor is provided with color filters, each color picked up has a separate output register"**.

The combination teaches a CMOS sensor used to capture the 3D and 2D images. Color filters in CMOS image sensors such as Bayer filter arrays are well known in the art. In addition, splitting the colors up so that each color has a separate output register is well known in the art. Therefore, it would have been obvious to one of ordinary skill in the art to provide color filters over the 2D area of the image sensor to achieve the predictable result of capturing color data, since capturing the 2D information in color is in no way dependent on the other aspects of the device, and to apply the

technique of providing each color with a separate output register to achieve the predictable result of a quicker readout.

Regarding claim 14, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 10), in addition, Leonard discloses an A/D converter (30) arranged to convert the electrical charges from an analog to a digital format, wherein the output register (34) is a digital output register, which reads on claimed, **"an A/D converter arranged to convert the electrical charges from an analog to a digital format, wherein the output register is a digital output register",** as exhibited in figures 4 and 5.

Regarding claim 15, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 9), in addition, Leonard discloses an image/signal processing unit arranged to analyze the electrical charges, which reads on claimed, **"an image/signal processing unit arranged to analyze the electrical charges",** as exhibited in figures 7 and 8. Specifically, Leonard discloses a separate processor may analyze the image as disclosed in column 5 lines 29-46.

Regarding claim 16, Leonard discloses a method and apparatus for evaluating integrated circuit packages having three dimensional features.

In addition, Leonard discloses a first area of pixels (38,40) having a first degree of resolution, the first area imaging three-dimensional geometrical characteristics of the

object; and a second area of pixels (42) having a second degree of resolution, the second area imaging two-dimensional characteristics of the object (balls, leads, edges, and corners), wherein the first area of pixels (38,40) and the second area of pixels (42) absorb electro-magnetic radiation from the object (26) and to convert the electro-magnetic radiation into electrical charges, which reads on claimed, **"a first area of pixels having a first degree of resolution, the first area imaging three-dimensional geometrical characteristics of the object; and a second area of pixels having a second degree of resolution different from the first degree of resolution, the second area having two-dimensional characteristics of the object, wherein the first area of pixels and the second area of pixels absorb electromagnetic radiation from the object and convert the electromagnetic radiation into electrical charges"**, as disclosed in column 12 lines 23-47 and exhibited in figures 3, 10, and 17.

However, Leonard fails to explicitly disclose that the second area of pixels has a higher degree of resolution different from the first degree of resolution. However, the examiner maintains that it was well known in the art to provide **"a second area of pixels having a second degree of resolution different from the first degree of resolution"**, as taught by Eberhard.

In a similar field of endeavor Eberhard discloses a cone beam spotlight using multi-resolution area detector. In addition, Eberhard discloses using an image sensor with a high resolution part and a low resolution part for 3-D imaging, wherein the high resolution part is used to image the small specific parts of interest of an object which reads on claimed, **"a second a second area of pixels having a second degree of**

**resolution different from the first degree of resolution"**, as disclosed in column 7 lines 25-68, and exhibited in figures 1 and 3.

Leonard teaches using an imager with two sections, one for imaging smaller specific 2D characteristics such as balls, edges, leads, and corners of an IC and one for imaging the 3D characteristics in a much broader perspective. Eberhard teaches a multiresolution sensor wherein the high resolution part of the sensor is used to image the details of the object, while the lower resolution part of the sensor is used to image the object in a broader sense.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of using high resolution to image the details of an object and lower resolution to image the other aspects of the object, as taught by Eberhard, to the sensor (10) of Leonard so that the pixel area (42) has a higher resolution than the pixel area (38,40) to achieve the predictable result of imaging the details of the object such as balls, edges, leads, and corners with better accuracy. In addition, simply increasing the resolution of the pixel area (42) of Leonard is not dependent on any other aspect of the device.

Regarding claim 17, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), in addition, Leonard discloses the three-dimensional geometrical characteristics include, width, height, and volume, which reads on claimed, **"wherein the three-dimensional geometrical characteristics include width, height, and volume",** as exhibited in figures 7-9.

Regarding claim 18, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), in addition, Leonard discloses the two-dimensional characteristics include structural orientation (corners, edges) and position, which reads on claimed, **“wherein the two-dimensional characteristics include [features which are representative of defects], structural orientation, and position”,** as disclosed in column 12 lines 23-47.

However, the combination fails to explicitly disclose that the two-dimensional characteristics include cracks, structural orientation, and position. However, the examiner takes official notice of the fact that it was well known in the art at the time of the invention to specifically provide **“wherein the two-dimensional characteristics include cracks”**.

The combination teaches an image sensor with that can capture two-dimensional characteristics representative of a defective IC, but not specifically cracks on the IC. Cracks are well known to be indications of defective ICs.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide that the two-dimensional characteristics include cracks for the purpose of finding defects to efficiently reject an IC defects before processing as disclosed in column 12 lines 23-26.

Regarding claim 19, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), however, Leonard fails to explicitly

disclose **"wherein the second area of pixels has a greater pixel density across the sensor in a direction perpendicular to a scanning direction than the first area of pixels"**. However, the examiner maintains that it was well known in the art to provide **"wherein the second area of pixels has a greater pixel density across the sensor in a direction perpendicular to a scanning direction than the first area of pixels"**, as taught by Eberhard.

In addition, Eberhard discloses, **"wherein the second area of pixels (14) has a greater pixel density across the sensor (10) in a direction perpendicular to a scanning direction than the first area of pixels (12)"**, as exhibited in figure 1.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Leonard by specifically providing **"wherein the second area of pixels has a greater pixel density across the sensor in a direction perpendicular to a scanning direction than the first area of pixels"**, as taught by Eberhard, for the purpose of reducing cost and complexity of the device since the resolution needed for the 2D images used to determine leads, edges, and corners, is not necessary for the 3D images which are only used to measure an amount of light at different positions as disclosed in Eberhard (column 7 lines 15-25).

Regarding claim 20, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 9), however, Leonard fails to explicitly disclose **"wherein the second area of pixels has a greater pixel density across the sensor in a direction perpendicular to a scanning direction than the first area of**

**pixels"**. However, the examiner maintains that it was well known in the art to provide **"wherein the second area of pixels has a greater pixel density across the sensor in a direction perpendicular to a scanning direction than the first area of pixels"**, as taught by Eberhard.

In addition, Eberhard discloses, **"wherein the second area of pixels (14) has a greater pixel density across the sensor (10) in a direction perpendicular to a scanning direction than the first area of pixels (12)"**, as exhibited in figure 1.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Leonard by specifically providing **"wherein the second area of pixels has a greater pixel density across the sensor in a direction perpendicular to a scanning direction than the first area of pixels"**, as taught by Eberhard, for the purpose of reducing cost and complexity of the device since the resolution needed for the 2D images used to determine leads, edges, and corners, is not necessary for the 3D images which are only used to measure an amount of light at different positions as disclosed in Eberhard (column 7 lines 15-25).

Regarding claim 3, Leonard and Eberhard, the combination discloses everything claimed as applied above (see claim 16), however, the combination fails to explicitly disclose **"wherein at least one of the two areas is provided in its entirety or partially with color filters in order to image the object in color"**. However, the examiner takes official notice of the fact that it was well known in the art at the time of

the invention to provide **“wherein at least one of the two areas is provided in its entirety or partially with color filters in order to image the object in color”**.

The combination teaches using a CMOS image sensor to capture 3D and 2D image characteristics. Using a color filter such as a Bayer filter with CMOS image sensors to produce a color image is well known in the art.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a color filter over the CMOS image sensor or a part of the image sensor to achieve the predictable result of capturing color data.

Regarding claim 4, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), however, Leonard fails to explicitly disclose **“wherein the first area is designed as a matrix having N rows and M columns, that the second area is designed as a matrix having X rows and Y columns and that Y is b multiplied by M columns, where b is an integer greater than zero”**. However, the examiner maintains that it was well known in the art to provide **“wherein the first area is designed as a matrix having N rows and M columns, that the second area is designed as a matrix having X rows and Y columns and that Y is b multiplied by M columns, where b is an integer greater than zero”**, as taught by Eberhard.

In addition, Eberhard discloses wherein the first area (12) is designed as a matrix having N rows and M columns, that the second area is designed as a matrix having X rows and Y columns and that Y is b multiplied by M columns, where b is an integer greater than zero, which reads on claimed, **“wherein the first area is designed as a**

**matrix having N rows and M columns, that the second area is designed as a matrix having X rows and Y columns and that Y is b multiplied by M columns, where b is an integer greater than zero"**, as exhibited in figure 1.

Leonard teaches using an imager with two sections, one for imaging smaller specific 2D characteristics such as balls, edges, leads, and corners of an IC and one for imaging the 3D characteristics in a much broader perspective. Eberhard teaches a multiresolution sensor wherein the high resolution part of the sensor is used to image the details of the object, while the lower resolution part of the sensor is used to image the object in a broader sense.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of using high resolution to image the details of an object and lower resolution to image the other aspects of the object, as taught by Eberhard, to the sensor (10) of Leonard so that the pixel area (42) has a higher resolution than the pixel area (38,40) to achieve the predictable result of imaging the details of the object such as balls, edges, leads, and corners with better accuracy. In addition, simply increasing the resolution of the pixel area (42) of Leonard is not dependent on any other aspect of the device.

Regarding claim 5, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 4), Leonard discloses the surface (36) with the IC package is moved with respect to the sensor (10), in column 6 lines 31-67. However, the combination fails to explicitly disclose that time delay integration is used on the

second area. However, the examiner takes official notice of the fact that it was well known in the art at the time of the invention to provide **“wherein time delay integration is used on the second area”**.

The combination teaches a sensor which has a high resolution 2D imaging section and a low resolution 3D imaging section wherein the surface with the IC package is moved with respect to the sensor. Images of a moving object taken using time delay integration are well known in the art.

Therefore, it would have been obvious to one of ordinary skill in the art at the invention was made to provide that the 2D imaging section captures images using time delay integration for purpose of improving the signal to noise ratio.

Regarding claim 7, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), in addition, Leonard discloses wherein the first area (38,40) and the second area (42) are arranged parallel in a transverse direction as two separate units, which reads on claimed, **“wherein the first area and the second area are arranged in parallel in a transverse direction as [two separate units]”,** as exhibited in figure 10. However, the combination fails to explicitly disclose that the two areas are one integral unit. However, the examiner takes official notice of the fact that it was well known in the art at the time of the invention to provide **“one integral unit”**.

The combination teaches a sensor with two separate areas as two separate units. Sensors with multiple areas as one integral unit are well known in the art.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of providing the multiple sensor areas as an integral unit to achieve the predictable result of taking up less space.

Regarding claim 8, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), in addition, Leonard discloses wherein the first area (38,40) and the second area (42) are arranged parallel in a transverse direction as two separate units, which reads on claimed, **"wherein the first area and the second area are arranged in parallel in a transverse direction as two separate units",** as exhibited in figure 10.

***Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Leonard in view of Eberhard further in view of Aoyama (US Patent 6,320,618 B1).***

Regarding claim 12, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 11), however, the combination fails to explicitly disclose the first and second areas of the sensor are each read out on a separate output register. However, the examiner maintains that it was well known in the art to provide **"wherein the first area and the second area of the sensor are each read out on a separate output register"**, as taught by Aoyama.

In a similar field of endeavor Aoyama discloses s semiconductor image sensor with a plurality of different resolution areas. In addition, Aoyama discloses the first area

(103) and the second area (101) of the sensor (fig. 6) are each read out on a separate output register (11) which reads on claimed, **"wherein the first area and the second area of the sensor are each read out on a separate output register"**, as exhibited in figure 6.

The combination teaches an image sensor wherein a first area of the image sensor is low resolution and captures 3D image profiles, and a second area is high resolution and captures 2D image profiles, wherein the two separate profiles are outputted to a shift register. Aoyama teaches an image sensor with a first area having low resolution and a second area having high resolution wherein each area has a separate shift register.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of using two separate shift registers for the two image profiles of the combination to achieve the predictable result of a quicker read out.

***Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Leonard in view of Eberhard further in view of Spears et al. (US Patent 7,027,193 B2) hereinafter referenced as Spears.***

Regarding claim 6, Leonard and Eberhard, the combination, discloses everything claimed as applied above (see claim 16), however, the combination fails to explicitly

disclose **"wherein at least one of the areas is provided with filters for different wavelengths in order to minimized crosstalk"**. However, the examiner maintains that it was well known in the art to provide **"wherein at least one of the areas is provided with filters for different wavelengths in order to minimized crosstalk"**, as taught by Spears.

In a similar field of endeavor Spears discloses a controller for photosensor array with multiple different sensor areas. In addition, Spears discloses wherein at least one of the areas is provided with filters (IR filter) for different wavelengths in order to minimize crosstalk, which reads on claimed, **"wherein at least one of the areas is provided with filters for different wavelengths in order to minimize crosstalk"**, as disclosed in column 4 lines 32-33.

The combination teaches an image sensor with different sensor areas. Spears teaches an image sensor with different sensor areas wherein one of the areas filters for a different wavelength.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of filtering the IR light out of one of the sensors to achieve the predictable result of blocking unwanted light.

**(10) Response to Argument**

Appellant argues that "Leonard does not suggest regions having different pixel densities". In addition, Appellant argues that "Eberhard et al. also does not suggest a sensor that includes two different regions that measure different information about an

object with different resolutions. Rather, Eberhard et al. suggests a sensor that includes regions that capture the same type of information with different resolutions."

The examiner cannot agree. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Neither Leonard nor Eberhard are used individually to teach this combination of features. Instead, the combination of Leonard and Eberhard is used to teach this combination of features. For instance, Leonard is relied upon for teaching a sensor with two areas capable of capturing 3D and 2D data respectively while Eberhard is relied upon for teaching a sensor with multiple resolutions.

As clearly stated in column 6 lines 45-47 and exhibited in figure 10 of Leonard, the sensor 10 includes a pixel area 38/40 for capturing 3D image data and a pixel area 42 for capturing 2D image data. Therefore, Leonard teaches a sensor with a first area (the 3D area) which captures information about the volume of an object (as exhibited in figures 7 and 8) and a second area (the 2D area) which captures information about specific characteristics of the object including the position, edge, corners, and other landmarks (column 12, lines 23-25, 33-35 and 45-47) or lack thereof to find defects. In addition Leonard's sensor is arranged so that the first area is the outer area and the second area is the inner area.

Meanwhile, as disclosed in column 5 lines 1-3 and exhibited in figures 1 and 3 of Eberhard, the sensor 10 includes a pixel area 12 for capturing medium resolution data

and a pixel area 14 for capturing high resolution data. Therefore, Eberhard teaches a sensor with two areas wherein the first area is a medium resolution area and the other area is a high resolution area for capturing information about an area of an object where defects are more critical (column 7 lines 25-29). In addition, Eberhard's sensor is arranged so that the first area surrounds the second area.

In addition, applying Eberhard's technique of providing high resolution to an inner area for inspecting critical defects is applied to Leonard's sensor including an outer 3D area and an inner 2D area for inspecting defects, would have yielded predictable results. One of ordinary skill could have easily predicted that adding more pixels per square inch to the inner 2D area would result in the ability to capture more information about a critical portion of an object.

Therefore, because applying Eberhard's technique to Leonard's sensor would yield predictable results, the combination is obvious and all of the limitations are taught by the combination.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Paul Berardesca/

Examiner, Art Unit 2622

Conferees:

/TUAN HO/

Primary Examiner, Art Unit 2622

/Sinh Tran/

Supervisory Patent Examiner, Art Unit 2622